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Fax Cover Sheet

Date: 04 Nov 2003

To: Charles Hanor	From: David Rogers
Application/Control Number: 09/943189	Art Unit: 2856
Fax No.: (210) 558-9509	Phone No.: (703) 305-4451
Voice No.: (210) 558-9500	Return Fax No.: (703) 746-8499
Re: REQUEST FOR COPY OF OFFICE ACTION	CC:
<input type="checkbox"/> Urgent <input type="checkbox"/> For Review <input checked="" type="checkbox"/> For Comment <input type="checkbox"/> For Reply <input checked="" type="checkbox"/> Per Your Request	

Comments:
Charles,

Attached is a copy of the office action mailed on 23 October 2003.

David Rogers

Number of pages 22 **including this page**

STATEMENT OF CONFIDENTIALITY

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A W

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/943,189	08/30/2001	David L. Morris	P-7764.006	8496

7590

10/23/2003

Gunn, Lee, & Hanor, P.C.
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EXAMINER

ROGERS, DAVID A

ART UNIT PAPER NUMBER

2856

DATE MAILED: 10/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application N .

09/943,189

Applicant(s)

MORRIS, DAVID L.

Examiner

David A. Rogers

Art Unit

2856

A-W

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-49 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 August 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Due to extenuating circumstances, the examiner for this application has been changed. Please ensure all future correspondence with regard to this case is directed to the examiner named below.

Response to Arguments

2. Applicant's arguments with respect to claims 1-49 have been considered but are moot in view of the new ground(s) of rejection.

Response to Amendment

3. The declaration under 37 CFR 1.132 filed 18 June 2003 is insufficient to overcome the rejection of claims 1, 2, 4, 11, 13-15, 20, 22, 24, 28, 29, 37, 39-43, and 45 as set forth in the last Office action because: The declaration introduces statements that the applicant had knowledge and possession of the prior art as early as 1988. The declaration, along with newly discovered art, sets forth new grounds of rejections.

Allowable Subject Matter

4. The indicated allowability of claims 3, 6-10, 12, 16-19, 21, 23, 25-27, 30-35, 36, 38, 44, and 46-49 is withdrawn in view of the newly discovered reference(s) listed below. Rejections based on the newly cited reference(s) follow.

Drawings

5. Figures 2 and 3 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

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6. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: Reference number "240" in figure 2 and reference number "390" in figure 3. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

7. The disclosure is objected to because of the following informalities.

Page 12, line 14 should read --central portion 210-- vice --central portion 224--.

Page 19, lines 4-6, the statement that the tube rotates at slower speeds of 250 rpm to 1600 rpm is confusing as it is not clear how 1600 rpm is slower than 1400 rpm or 300 rpm.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-25, 28-37, and 39-45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "generally free" in claims 1, 15, 22, 24, 28, 37, 39, 40, and 45 is a relative term which renders the claim indefinite. The term "generally free" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The claims and the disclosure do not provide for how one determines the existence of

the scratches, how one determines which scratch sizes are not acceptable, i.e. which depths at what magnification, and how one determines which scratch sizes are acceptable.

10. Claims 11, 12, and 20-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The term "flat enough" in claims 11, 12, and 20-22 is a relative term which renders the claim indefinite. The term "flat enough" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The claims and the specification do not provide for the degree to which light coherence must be maintained, and how that degree of light coherence is to be measured so as to determine that the proper substrate finish is obtained.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(c) he has abandoned the invention.

12. Claims 48 and 49 are rejected under 35 U.S.C. 102(c) because the invention has been abandoned. The applicant admits on the record that the roller burnishing equipment, as seen in figure 2, was used in 1988-1989 to develop a roller-burnished heater tube by drawing the tapered rollers inwardly against the tube's outer substrate to work harden/burnish the outer substrate to a highly-polished, mirror-like finish. The applicant was using heater tubes with a central portion of smaller diameter relative to its outer ends. In the letter dated 03 May 200, exhibit C of the Rule 132 affidavit filed 18 June 2003 as paper #09, it is stated that "the project was abandoned"

on statement 22. See also the letter dated 03 May 2000, submitted as part of Exhibit C, where it is stated “[f]or whatever reason, it was decided that burnishing was not viable and the project was abandoned.”

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(f) he did not himself invent the subject matter sought to be patented.

14. Claims 1, 4, 5, 6, 11, 13, 14, 15, 20, 22-29, 37-40, 42, 45, 46, 48, and 49 are rejected under 35 U.S.C. 102(f) because the applicant did not invent the claimed subject matter. On page 15 of the applicant’s arguments it is stated “[t]his suit was dismissed with prejudice and thus finally decided the ownership of Applicant’s invention.” It is also stated on this page that “[n]otwithstanding that this prior suit constitutes *res judicata* and is a final determination as to ownership by Applicant of the invention of this patent application, Petroleum Analyzer Company, L.P. (PAC) is again claiming ownership of the invention.” The case was dismissed by the court, submitted as Exhibit B, as the applicant and PAC compromised and settled. The court did not institute a finding that the applicant was either the sole inventor or the owner of the invention. There is no documentation on the record delineating the terms of the compromise and settlement, which might have included agreements by the applicant that PAC does own certain rights to the invention. Furthermore, in the letter dated 03 May 200, submitted as Exhibit C, it is alleged by Mr. Ted Lee, who is still listed as an Attorney-of-Record for this application, that the applicant “stole from ALCOR, Inc.” (now PAC). In view of the fact that a) the courts did not institute a finding of ownership and inventorship, b) there is no supporting documentation that delineates the compromise and agreements between the applicant and PAC, and b) that the PAC

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is still seeking ownership of the invention, this rejection hereby stands. This rejection may be overcome either by admissions by PAC that they do not own or did not invent the coupons, apparatus, or methods listed in the claims above or by amending the independent claims so that they are not limited by matter to which PAC is seeking to claim ownership.

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. Claims 1-8, 11-17, 20-29, 37-39, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent 5,101,658 to Wilson, III *et al.* in view of the ASTM Standard D3241-98, the Applicant's admitted prior art, and European Patent Application EP 0994394 to Akagi *et al.* Roller burnishing, a form of cold-working of metals, is well known in the art. It is also well known that roller burnishing provides a work-hardened, mirror-like substrate finish for materials used in a variety of applications. It is also known that roller burnishing is a controlled process that is repeatable on subsequent substrates so that the substrates will each have similar finishes. Finally, it is noted that a work-hardened substrate is an ancillary result of the method used to obtain the required substrate finish. ASTM standards for fuel testing, such as ASTM D3241-98, 01, or even -02a, which are the standards by which the heater tubes are to be used in the testing of fuel, do not require heater tubes to have work-hardened substrates. A work-hardened substrate may be preferred for certain fatigue-related operating conditions in order to impede crack initiation or retard crack growth, but is not needed

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for the short-term fuel testing required by the ASTM standards. Wilson, III *et al.* teaches that it is known to use a heater tube (reference item 42) in order to determine the thermal stability of fuels. As seen in Figure 4, the tube is formed as an elongated member that has a reduced diameter central region. As stated in Wilson, III *et al.* (see column 6, lines 57-68) (emphasis added):

“The heater tube 42 is generally of circular cross-section and of metallic construction. The type of metal utilized will be dependent upon the operating temperature involved in a specific test. While aluminum is preferred because of the low manufacturing costs, other metals such as stainless steel and titanium may be used if higher temperatures are required or it is desired to duplicate the metal of a specific end application. An important consideration in the manufacture of the heater tube 42 is that of obtaining a surface finish suitable for rating the level of fuel deposits thereon. Normally this requires a highly polished surface that can be accurately maintained with consistency so that deviations from tube to tube will be reduced to a minimum. The deposition level can be either evaluated visually in comparison with a color standard, or by utilizing some other suitable means for sensing the level of deposits.”

ASTM Standard D3241-98 requires that the substrate of the tube be visually inspected, which means that poor substrate conditions will render the test results unusable or unattainable.

Therefore, it is well established in the art that the substrate finish of the heater tubes is critical to the success of interpreting the results of thermal testing of fuels. In addition to the above, the applicant admits to the following:

- a. Roller burnishing of heater tubes to obtain a highly polished outer substrate was performed during the period of 1988-1989;
- b. Roller burnished heater tubes did not have the proper substrate finish required for sale/use;
- c. Roller burnishing machines used in 1988-1989 were available on the open market; and

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- d. The primary, if not sole, difference between the claimed heater tubes and the known prior art heater tubes is the roller-burnished outer substrate.

As noted above, roller burnishing produces samples with consistently equivalent finishes.

Therefore, based on the above, it is known to provide heater tubes with a highly polished outer substrate. It is also known from the above that the outer substrate of the heater tubes can be roller-burnished in order to obtain the highly polished substrate that is consistent from tube to tube. What is not expressly taught by either Wilson, III *et al.*, ASTM Standard D3241, or the applicant's admitted known art is obtaining an outer substrate of the heater tube that has a burnished surface with a mean depth of 500 nm or even 100 nm. The applicant used roller burnishing in 1988-1989 to obtain heater tubes with a mirror-like substrate finish, and it is well established that roller-burnished surfaces are scratch-free when inspected using a predetermined magnification. However, as the applicant admits, the degree of compression of the peaks of the substrate was not sufficient, which provides one of ordinary skill the motivation to seek ways to obtain the desired substrate finish. Therefore, obtaining a substrate that is "generally free or random, minute scratches" merely represents an optimization of the techniques already known and used and can be accomplished by varying the burnisher's speed or pressure or the drawing speed of the material. Even without the benefit of the applicant's admitted prior art, Akagi *et al.* teaches that it is well known to use roller burnishing to obtain an aluminum or aluminum alloy tube with a highly polished outer substrate finish. With regard to alloys it is also noted that the 6061-series of aluminum alloys have been around for many years and are available in a wide range of shapes and sizes. This series of aluminum alloys, of various tempers, are used in many applications such as pistons and cylinders for internal combustion engines. As such, its use as

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heater tubes would have been obvious since it could better replicate the actual operating conditions of internal combustion engines. As in the instant application, Akagi *et al.*'s aluminum tube substrate is critical as it uses reflected light to maintain a high-quality image and would also be seamless so as to avoid any image distortion. As seen in the Abstract of Akagi *et al.* the roller burnishing obtains a substrate roughness of less than 0.5 microns, which is 500 nm. Akagi *et al.* also teaches that it is known to obtain a substrate finish of less than 0.1 microns, which is 100 nm, or even 0.08 microns, which is 80 nm. This type of substrate will be free of the "random, minute scratches" that the applicant admits as being detrimental to the successful interpretation of the test results, and it would, therefore, be flat enough to be measured by an ellipsometric tube analyzer. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* with the teachings of ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* in order to obtain a heater tube with a highly polished outer substrate by means of roller burnishing to less than 100 nm so that the substrate can be examined using an ellipsometric tube analyzer.

17. Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* as applied to claims 1 and 6 above, and further in view of United States Patent 5,733,178 to Ohishi. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* teaches that it is known to form tubes with a burnished outer substrate where the substrate finish has a mean depth of less than 100 nm, or even 80 nm. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* does not teach a substrate finish that does not exceed 10 nm, or even

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20 nm, which is merely an optimization of the substrate finishes of that already obtained by the applicant in 1988-1989 and knowing that Akagi *et al.* already teaches a burnished surface of about 80 nm. Furthermore, Ohishi teaches that it is known in the art of polishing substrates to obtain a mean depth 3.03 to 3.76 nm (see table 3). The polished member is a metal disk with a metal substrate. The disk and its substrate have a mean depth (Ra) between 0.002 microns to 0.007 microns, which is about 2 nm to 7 nm. Furthermore, as stated in Ohishi (column 13, lines 7-15):

“However, while certain range values have been described above in connection with using the abrasive composite ridges to texture rigid memory disks, it is to be understood the method of the invention may be applicable to many other roll to roll indexing or running applications, such as floppy disk or magnetic tape burnishing, magnetic head polishing, roll polishing, and the like. The optimal pattern size and angle may vary and can be empirically determined for each application and mineral size of abrasive employed.”

It is clearly within the scope of one of ordinary skill in the art to obtain a substrate finish of less than 10 nm. Since the tubes are analyzed with a light source, it would have been obvious to one of ordinary skill in the art that the substrate that reflects the light be as smooth as possible in order to avoid dispersion that might cause a misreading of the test results. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* with the teachings of Ohishi to obtain a tube with a substrate finish of 10 nm to 20 nm.

18. Claims 18 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* as applied to claim 15 above, and further in view of United States Patent 5,733,178

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to Ohishi. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* teaches that it is known to form tubes with a burnished outer substrate where the substrate finish has a mean depth of less than 100 nm, or even 80 nm. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* does not teach a substrate finish that does not exceed 10 nm, or even 20 nm, which is merely an optimization of the substrate finishes of that already obtained by the applicant in 1988-1989 and knowing that Akagi *et al.* already teaches a burnished surface of about 80 nm. Furthermore, Ohishi teaches that it is known in the art of polishing substrates to obtain a mean depth 3.03 to 3.76 nm (see table 3). The polished member is a metal disk with a metal substrate. The disk and its substrate have a mean depth (Ra) between 0.002 microns to 0.007 microns, which is about 2 nm to 7 nm. Furthermore, as stated in Ohishi (column 13, lines 7-15):

"However, while certain range values have been described above in connection with using the abrasive composite ridges to texture rigid memory disks, it is to be understood the method of the invention may be applicable to many other roll to roll indexing or running applications, such as floppy disk or magnetic tape burnishing, magnetic head polishing, roll polishing, and the like. The optimal pattern size and angle may vary and can be empirically determined for each application and mineral size of abrasive employed."

It is clearly within the scope of one of ordinary skill in the art to obtain a substrate finish of less than 10 nm. Since the tubes are analyzed with a light source, it would have been obvious to one of ordinary skill in the art that the substrate that reflects the light be as smooth as possible in order to avoid dispersion that might cause a misreading of the test results. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the

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teachings of Akagi *et al.* with the teachings of Ohishi to obtain a tube with a substrate finish of 10 nm to 20 nm.

19. Claims 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* as applied to claim 30 above, and further in view of "Burnishing Products" to Elliott Tool Technologies and United States Patent 5,540,883 to Jones *et al.* Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* teaches that it is known to form tubes with a burnished outer substrate. The applicant admits that the tool used to burnish the outer substrate of the tubes (see figure 2 of the instant application) was first used in 1988-1989, and this particular tool draws the tube through the burnishing tool. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* does not teach the use of a tool that operates between 100 rpm and 300 rpm to burnish the outer substrate. Elliott Tool Technologies teaches that it is known to operate burnishing tools between 70 rpm and 1500 rpm (see page 4). However, Elliott Tool Technologies does not teach that it is known to operate burnishing tools at a range less than their recommended speed. Jones *et al.* teaches that it is known in the art of roller burnishing to operate a burnishing tool at a speed substantially less than the recommended setting (column 9, lines 11-17). In the case of Jones *et al.*, the speed was reduced to a maximum of 3.75% of its recommended setting of 800 rpm in order to "get particularly good results." This is the same reason as to why the applicant reduces the speed of the burnishing tool from its recommended operating speed. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.*, ASTM Standard D3241-98, the

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applicant's admitted prior art, and the teachings of Akagi *et al.* with the teachings of Elliott Tool Technologies and Jones *et al.* in order to operate a burnishing tool at a speed of between 100 rpm and 300 rpm while drawing the tube through the tool.

20. Claims 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, and Jones *et al.* as applied to claims 28, 30, and 32 above, and further in view of United States Patent 5,223,718 to Taboada. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, and Jones *et al.* teaches that it is known to use a tube with a reduced diameter central region in the performance of fuel deposit testing. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, and Jones *et al.* does not teach the use of a "biconical or dual step tapered zone" to obtain the reduced diameter. Taboada teaches the use of a tube in the analysis of deposits of fuels. The tube (reference item 30), as seen in Figures 2 and 3, comprises a dual radius tapering on each end of the tube to form a central region of reduced diameter relative to the outer regions. This is a common means to reduce the diameter of members such as test coupons. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, and Jones *et al.* with the teachings of Taboada in order to obtain a tube with a dual-radius tapered region that forms a central region of reduced diameter.

21. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool

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Technologies, Jones *et al.*, and Taboada as applied to claims 28, 30, 32, and 34 above, and further in view of United States Patent 6,332,652 to Nakakuro. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, and Jones *et al.* teaches that it is known to burnish parts using a machine whose speed is reduced from its recommended speed. Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, Jones *et al.*, and Taboada does not teach the use of an inverter for speed control. Power inverters are quite common in the art and its use as a speed controller is well known. In order to show this, Nakakura teaches that it is known to utilize an inverter to control the speed of a motor. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.*, ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, Elliott Tool Technologies, Jones *et al.*, and Taboada with the teachings of Nakakura to obtain a process to burnish test coupons comprising a burnishing machine with an inverter to reduce the speed of the burnishing machine from its recommended speed.

22. Claims 40-42, 46, and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of the ASTM Standard D3241-98, the Applicant's admitted prior art, and European Patent Application EP 0994394 to Akagi *et al.* Wilson, III *et al.* teaches that it is known to test fuels using an aluminum tube (reference item 42) with a central bore. The tube is heated, and pressurized fuel is pumped through the housing that holds the tube. After the test, the tube is removed and inspected for deposits. Wilson, III *et al.* does not teach the use of a burnished tube for the fuel test. Roller burnishing, a form of cold-working of metals, is well known in the art. It is also well known that roller burnishing provides a work-hardened, mirror-

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like substrate finish for materials used in a variety of applications. It is also known that roller burnishing is a controlled process that is repeatable on subsequent substrates so that the substrates will each have similar finishes. Finally, it is noted that a work-hardened substrate is an ancillary result of the method used to obtain the required substrate finish. ASTM standards for fuel testing, such as ASTM D3241-98, 01, or even -02a, which are the standards by which the heater tubes are to be used in the testing of fuel, do not require heater tubes to have work-hardened substrates. A work-hardened substrate may be preferred for certain fatigue-related operating conditions in order to impede crack initiation or retard crack growth, but is not needed for the short-term fuel testing required by the ASTM standards. Wilson, III *et al.* teaches that it is known to use a heater tube (reference item 42) in order to determine the thermal stability of fuels. As seen in Figure 4, the tube is formed as an elongated member that has a reduced diameter central region. As stated in Wilson, III *et al.* (see column 6, lines 57-68) (emphasis added):

“The heater tube 42 is generally of circular cross-section and of metallic construction. The type of metal utilized will be dependent upon the operating temperature involved in a specific test. While aluminum is preferred because of the low manufacturing costs, other metals such as stainless steel and titanium may be used if higher temperatures are required or it is desired to duplicate the metal of a specific end application. An important consideration in the manufacture of the heater tube 42 is that of obtaining a surface finish suitable for rating the level of fuel deposits thereon. Normally this requires a highly polished surface that can be accurately maintained with consistency so that deviations from tube to tube will be reduced to a minimum. The deposition level can be either evaluated visually in comparison with a color standard, or by utilizing some other suitable means for sensing the level of deposits.”

ASTM Standard D3241-98 requires that the substrate of the tube be visually inspected, which means that poor substrate conditions will render the test results unusable or unattainable.

Therefore, it is well established in the art that the substrate finish of the heater tubes is critical to

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the success of interpreting the results of thermal testing of fuels. In addition to the above, the applicant admits to the following:

- e. Roller burnishing of heater tubes to obtain a highly polished outer substrate was performed during the period of 1988-1989;
- f. Roller burnished heater tubes did not have the proper substrate finish required for sale/use;
- g. Roller burnishing machines used in 1988-1989 were available on the open market; and
- h. The primary, if not sole, difference between the claimed heater tubes and the known prior art heater tubes is the roller-burnished outer substrate.

23. As noted above, roller burnishing produces samples with consistently equivalent finishes. Therefore, based on the above, it is known to provide heater tubes with a highly polished outer substrate. It is also known from the above that the outer substrate of the heater tubes can be roller-burnished in order to obtain the highly polished substrate that is consistent from tube to tube. What is not expressly taught by either Wilson, III *et al.*, ASTM Standard D3241, or the applicant's admitted known art is obtaining an outer substrate of the heater tube that has a burnished surface with a mean depth of 500 nm or even 100 nm. The applicant used roller burnishing in 1988-1989 to obtain heater tubes with a mirror-like substrate finish, and it is well established that roller-burnished surfaces are scratch-free when inspected using a predetermined magnification. However, as the applicant admits, the degree of compression of the peaks of the substrate was not sufficient, which provides one of ordinary skill the motivation to seek ways to obtain the desired substrate finish. Therefore, obtaining a substrate that is "generally free or

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random, minute scratches” merely represents an optimization of the techniques already known and used and can be accomplished by varying the burnisher’s speed or pressure or the drawing speed of the material. Even without the benefit of the applicant’s admitted prior art, Akagi *et al.* teaches that it is well known to use roller burnishing to obtain an aluminum or aluminum alloy tube with a highly polished outer substrate finish. With regard to alloys it is also noted that the 6061-series of aluminum alloys have been around for many years and are available in a wide range of shapes and sizes. This series of aluminum alloys, of various tempers, are used in many applications such as pistons and cylinders for internal combustion engines. As such, its use as heater tubes would have been obvious since it could better replicate the actual operating conditions of internal combustion engines. As in the instant application, Akagi *et al.*’s aluminum tube substrate is critical as it uses reflected light to maintain a high-quality image and would also be seamless so as to avoid any image distortion. As seen in the Abstract of Akagi *et al.* the roller burnishing obtains a substrate roughness of less than 0.5 microns, which is 500 nm. Akagi *et al.* also teaches that it is known to obtain a substrate finish of less than 0.1 microns, which is 100 nm, or even 0.08 microns, which is 80 nm. This type of substrate will be free of the “random, minute scratches” that the applicant admits as being detrimental to the successful interpretation of the test results, and it would, therefore, be flat enough to be measured by an ellipsometric tube analyzer. With regard to claim 41, ASTM D3241-98 teaches that one should reject the tube if the central section is touched. ASTM D3241-98 does not expressly state that one should not clean the heater tube. One would, however, be motivated to clean the heater tube if the presence of dust or debris is found as a) it would ensure that the test results are valid and b) it would avoid the costly replacement of heater tubes that would have otherwise be rejected. It would have been

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obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* with the teachings of ASTM Standard D3241-98, the applicant's admitted prior art, and the teachings of Akagi *et al.* in order to obtain a method of testing fuel using a heater tube with a highly polished outer substrate by means of roller burnishing to less than 100 nm.

24. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, and Akagi *et al.* as applied to claim 40 above, and further in view of United States Patent 5,223,718 to Taboada. Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, and Akagi *et al.* teaches that it is known to use a burnished tube to test for the formation of deposits of fuel. Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, and Akagi *et al.* does not teach that the depth of the deposits is measured to provide an indication of the fouling tendency of the fuels. Taboada teaches that it is known to pass fuel over a heated tube in order to determine the fouling tendencies of the fuel. Furthermore, Taboada teaches that it is known to use a light source in order to determine the depth of the deposits left on the tube as a measure of the fouling tendency of the fuel. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, and Akagi *et al.* with the teachings of Taboada in order to obtain a method to test fuel fouling tendencies by measuring the depth of the deposits that remain on a tube.

25. Claim 44 is rejected under 35 U.S.C. 103(a) as being unpatentable over Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, and Taboada as applied to claims 40 and 43 above, and further in view of The International

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Association for Stability and Handling of Liquid Fuels (IASH) Newsletter No. 18 and/or 22.

Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, and Taboada teaches that it is known to use a burnished, hollow tube for the rating of the fouling tendencies of fuels. Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, and Taboada does not teach the use of an Ellipsometric Tube Analyzer to measure the depth of the fuel deposits. IASH newsletters 18 and 22 teach that it is known to use an Ellipsometric Tube Analyzer (ETA) in the analysis of heater tubes in order to determine the depth of the deposits left by the fuel during fouling testing. The ETA provides a three-dimensional aspect of the deposits, which can provide a better indication of the fouling tendency of the fuel. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the teachings of Wilson, III *et al.* in view of ASTM Standard D3241-98, the applicant's admitted prior art, Akagi *et al.*, and Taboada with the teachings of IASH in order to use an ETA to determine the fouling tendencies of fuel on heater tubes.

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Conclusion


26. Other citations with pertinent information with regard to the applicant's claims include:
- a. Stock Allowance - Surface Finish Chart" shows roller burnishing is used to obtain a surface finish of around 0.02 microns, or about 20 nm.
 - b. United States Patent 3,803,776 to Shafer *et al.* discloses that it is known to roller-burnish outer surfaces of tube materials.
 - c. United States Patent 4,154,464 to Stary discloses that it is known to roller burnish the surface of tubes and that "the mandrel advance is controlled to get the desired amount of burnishing of the tube hole surface".


27. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David A. Rogers whose telephone number is (703) 305-4451.

The examiner can normally be reached on Monday - Friday (0730 - 1600).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hezron E. Williams can be reached on (703) 305-4705. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.


October 6, 2003


HEZRON WILLIAMS
SUPERVISORY PATENT EXAMINER
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